Ministry
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PROVINCIAL ANALYSIS OF HOT-MIX COMPACTION 1986 TO 1988

MATERIALS INFORMATION

ENGINEERING MATERIALS OFFICE

PROVINCIAL ANALYSIS

OF HOT-MIX COMPACTION

1986 TO 1988

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SUMMARY

The Ministry of Transportation, Ontario, has monitored both main lane compaction and longitudinal joint compaction of hot-mix paving in a systematic manner throughout the Province over a three year period from 1986 to 1988. In 1986, 53% of main lane compaction met the minimum requirement of 96% compaction and this improved only marginally to 59% in 1988. It was found that compaction at either side of longitudinal joints was nearly equal and averaged about 1.2% less than the main lane paving.

A bonus of $0.10 per tonne was introduced in 1987 for hot-mix compacted to a minimum level of 60% exceeding 97% compaction. It was hoped that this bonus would encourage contractors to achieve a greater overall level of compaction. It did not. This bonus scheme has now been discontinued.

Compaction at the longitudinal joints did not improve over the monitoring period and the monitoring of compaction at this location has now been discontinued.

Main lane compaction monitoring will continue in 1989.

INTRODUCTION

In 1986, the Ministry of Transportation (Ontario) cored hot mix pavement to determine thickness and density in both main lane paving and 150 mm from the joint between adjacent lanes in the lane placed by the second paver, unless the pavers were working in echelon. If the lanes were paved in echelon, no cores were required at the joint. This work was reported in MI-111 "1986 Hot Mix Compaction Summary", May 1987. It was found that compaction 150 mm from the joint in the second lane paved averaged 0.6% less than the 96.1% compaction achieved in the main lanes. It had been expected that compaction near the joint in the second lane paved would exceed that near the joint in the first lane paved, due to edge confinement.

To determine the compaction actually attained on each side of a longitudinal joint in 1987, sets of two cores were cut from the mat, one on each side, unless the pavers were working in echelon as defined in OPSS Form 310.03. Furthermore, the 1987 cores were cut with the edge of the core coincidental with the joint itself to determine if densities were lower at the edge than 150 mm away. It was found that the compaction at the joint on the first lane paved was slightly higher than achieved on the second with provincial averages of 95.1 and 94.9 per cent respectively. This is about a half per cent less than found in 1986, 150 mm away from the joint in the second lane paved. The fact that compaction at the joint was on average less in the second lane paved was attributed to poor construction practices. The 1987 joint compaction data was reported in MI-121, "Hot Mix Joint Compaction In 1987" which included guides to proper joint construction for the benefit of field staff.

Monitoring of joint compaction was continued in the same manner for the 1988 construction season. This report summarizes the 1988 data and compares it to the previous years' summaries.

1988 Compaction Data

Compaction results for 1192 pairs of cores at longitudinal joints from four regions of the Province were entered into a micro-computer spread sheet for analysis. Northern Region did not cut any joint cores in 1988. Table I summarizes the joint compaction data by Region.

Table 2 presents the Regional data for main lane compaction. This data was extracted from the Quality Assurance Data Base (QUADB) which was in-put from the Regions on the main frame computer. Central Region did not in-put it's data, precluding retrieval and summation. The per cent within limits (PWL) shown in the table is the estimate of the population of compaction equal to or greater than the minimum requirement of 96%. The Provincial average of 59 PWL is slightly better than the 53 PWL achieved in 1986.

About half of the two million tonnes of hot mix placed on Ministry contracts in 1988 was eligible for a ten cent per tonne bonus for superior compaction. The bonus was paid on a lot by lot basis (days production) when a minimum 60% of the compacted mix exceeded 97% compaction. Table 3 is a summary, as submitted by the Regions, of hot-mix subject to the bonus. Only 21% of the mix eligible to receive the bonus actually qualified. The 205,542 t that did qualify, attracted a bonus over $20,500.00. In 1986, prior to the introduction of the bonus, analysis of the year's data indicated that 25% of the mix placed would qualify for a bonus payment. It is obvious from this data that the bonus was not an incentive to better compaction.

Figure 1 shows the relationship of main lane compaction to longitudinal joint compaction in 1988. An analysis of the data shows that on average, the compaction on the first side of the joint is 0.3% less than the second side and 1.6% less than achieved on the main lane paving.

Figure 2 shows the relationship of the compaction at either side of the joint over the monitoring period. As may be seen in the Figure, on average, joint compaction was slightly less in 1988 than in the previous year.

TABLE 1: SUMMARY OF JOINT COMPACTION IN 1988

REGION	# CORE SETS	1ST. LANE MEAN	1ST. LANE ST. DEV.	2ND. LANE MEAN	2ND. LANE ST. DEV.
NORTHWESTERN	407	95.0	2.1	95.3	2.3
NORTHERN	0				
EASTERN	336	94.6	1.8	94.6	1.7
CENTRAL	54	94.8	1.7	95.3	1.7
SOUTHWESTERN	395	94.5	2.1	94.7	2.2
ALL	1192	94.7		95.0	

TABLE 2: SUMMARY OF MAIN LANE COMPACTION IN 1988

REGION	NUMBER OF CORES	PER CENT COMPACTION	AVERAGE ST. DEV.	% WITHIN LIMITS
NORTHWESTERN	696	96.1	1.6	52
NORTHERN	285	97.2	1.1	85
EASTERN	762	95.5	1.6	38
CENTRAL	?	?	?	?
SOUTHWESTERN	660	96.5	1.6	62
ALL	2403	96.3	1.5	59

TABLE 3: 1988 COMPACTION BONUS SUMMARY

REGION	NO BONUS		BONUS	
	TONNES	AVE. % COMP.	TONNES	AVE. % COMP.
NORTHWESTERN	74,030	95.8	7,691	97.7
NORTHERN	200,463	96.3	123,737	97.9
EASTERN	190,149	95.8	14,778	97.6
CENTRAL	118,709	95.8	6,827	97.9
SOUTHWESTERN	196,276	95.9	52,509	97.9
ALL	779,627	95.9	205,542	97.8

FIGURE 1: 1988 COMPARISON OF MAIN LANE AND JOINT COMPACTION

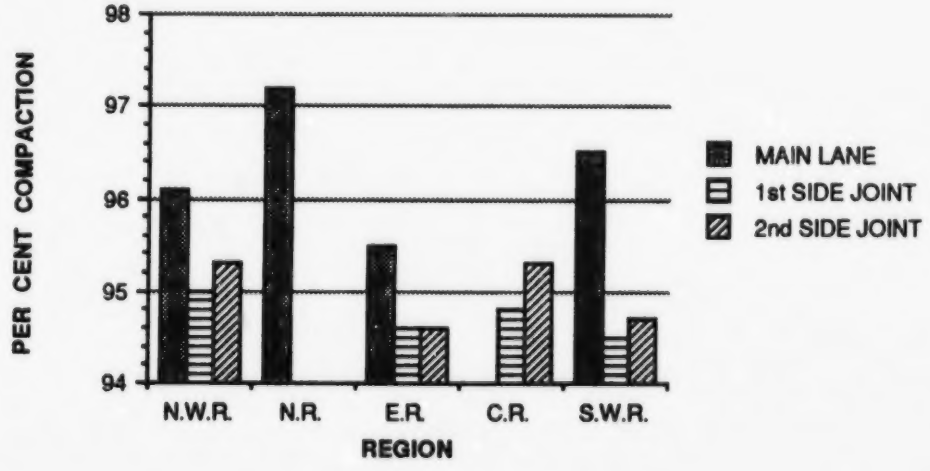
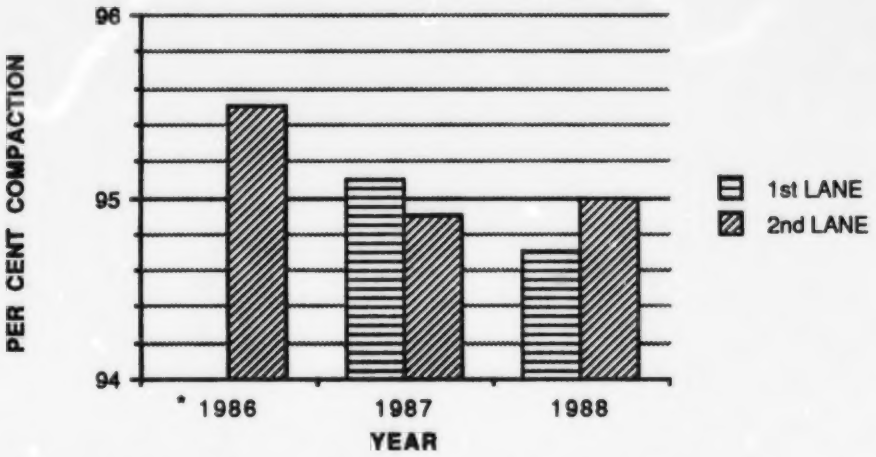


FIGURE 2: 3 YEAR COMPARISON OF JOINT COMPACTION



* Measured 15 cm from joint in second lane paved only.

DISCUSSION

The average compaction in the main lanes (96.3%) has changed little since 1986 (96.1%). Despite initiatives such as annual analysis and reporting of data and the bonus scheme, there has been virtually no improvement in the average level of compaction across the Province through the years 1986 to 1988 inclusive.

On average, joint compaction is about 1.2% lower than the main lane work. Enough data is now available to state these numbers with confidence.

In 1988 compaction at the longitudinal joint in the second lane paved averaged slightly higher (0.3%) than that of the first lane. This is a reversal from what was observed in 1987. With the lateral support offered by the first lane, compaction at the joint in the second lane should be equal to that achieved throughout the body of the mat (>96%) but it fell well short at 95.0%. This result clearly indicates poor construction practices still prevail at the longitudinal joints.

Since the bonus scheme did not prove to be an incentive for contractors to improve compaction and the fact it created extra administration for Ministry staff, it has been discontinued. Future development of an end-result specification for compaction may or may not contain a bonus for superior compaction along with price reductions for non-complying work.

Until new initiatives are taken to improve joint compaction, the monitoring of joint compaction has been terminated.

Routine monitoring of main lane compaction will continue in 1989 as over the last three years.

REFERENCES

Evers R. C., Cautillo G. and Lynch D. F. MI-111 "1986 Hot Mix Compaction Summary", May 1987.

Evers R. C. and Lynch D. F. MI-121 "Hot Mix Joint Compaction In 1987", May 1988.